of the sea breeze and the elevation at which the upper portions of the clouds are carried forward toward the land and dissipated by mixing of the cloudy air with the drier air at that elevation and the drier air rising from the bay. These clouds move slowly toward the north all night. The off-shore clouds are always quite low, although they vary considerably in the elevation of both base and top on different nights. The base of the clouds average in the neighborhood of 800 feet in elevation, which is somewhat higher than the theoretical elevation at which the moisture in the surface air should become sufficiently cooled to condense and form clouds. On clear bright nights, when radiation is most effective, the tops of the offshore clouds are much higher than when radiation is not so effective, which, as would be expected, indicates that the land breezes are much deeper on such nights than on nights when radiation is not so effective. The tops of these clouds are, on an average, about 1,500 feet during July and August and somewhat lower earlier and later in the season. In the morning, soon after the sun begins to warm up the land surface, the offshore clouds begin to move toward the land all along the coast, except opposite Corpus Christi Bay. The offshore clouds opposite the bay move somewhat more rapidly toward the north for more than an hour after the clouds farther north and south have passed inland. When the clouds opposite the bay reach a point nearly opposite the northern extremity of the bay, they turn sharply toward the northwest and move rapidly inland. The wind at Corpus Christi continues to blow from the south-southwest for more than an hour after the clouds north and south of the bay have passed inland.

About an hour and a half after sunrise the wind at Corpus Christi reaches its minimum velocity, which is usually a gentle breeze from the south-southwest, but occasionally from the southwest or west-southwest. After the minimum velocity is reached the wind gradually increases in velocity and shifts toward the southeast. An hour after the minimum velocity has occurred the wind is in the southeast and is increasing rapidly in velocity.

On the whole, it appears that this shallow superheated bay has the effect of delaying the appearance of the sea breeze in the morning and of hastening its end in the evening, as well as of weakening its force while it is blowing, but it would also appear that the course traveled by the sea breeze is somewhat longer than it would be if there were no such body of water to affect it. The land breezes are no doubt lengthened in duration, both in the morning and in the evening, and their force is considerably greater than would be the case if there were no bay

LAND AND SEA BREEZES AT BAYONNE, FRANCE.

By M. ROUCH.

[Comptes Rendus, Feb. 10, 1919, vol. 168, pp. 313-315.]

(Translation and abstract.)

From hourly observations of wind velocity and direction made at the aviation center at Bayonne at the southern end of the Bay of Biscay on clear days or days on which the cloudiness did not exceed 4/10, the author brings out the following facts:

1. Table 1, giving hourly components of the wind, was obtained by considering the observed wind at any hour to be made up of two components—i. e., the mean wind for the season and the hourly wind. By taking one side of a parallelogram proportional to the mean wind and the other side proportional to the observed wind, the diagonal gives the hourly wind.

TABLE 1.—*Hourly components of the wind at Bayonne, France.*

Hours	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.
Direction	S. 13° E.	S. 22° E.	S. 25° E.	S. 26° E.	S. 27° E.	S. 29° E.	S. 27° E.	S. 24° E.
Speed (m. p. s.)	1.2	1.7	1.8	1.7	1.7	1.9	1.8	1.5
Hours	**9 h.**	**10 h.**	**11 h.**	**12 h.**	**13 h.**	**14 h.**	**15 h.**	**16 h.**
Direction	S. 17° E.	S. 04° E.	N. 66° E.	N. 13° E.	N. 7° W.	N. 12° W	N. 8° W.	N. 11° W
Speed (m. p. s.)	1.2	0.7	0.2	0.5	1.4	2.3	2.9	3.0
Hours	**17 h.**	**18 h.**	**19 h.**	**20 h.**	**21 h.**	**22 h.**	**23 h.**	**24 h.**
Direction	N. 19° W	N. 22° W	N. 36° W	N. 80° W.	N. 78° W.	N. 69° W.	N. 50° W.	N. 44° W.
Speed (m. p. s.)	2.5	1.9	1.2	0.5	0.2	0.4	0.5	0.6

2. The land breeze is well marked from midnight to 10 a. m., and the sea breeze from 1 p. m. to 7 p. m., with transition periods between. The land and sea breezes do not blow at right angles to the shore line but are inclined to it.

3. The sea breeze is stronger than the land breeze, the speed of the former being 3 m. p. s., while that of the latter is 1.9 m. p. s.

4. No marked influence of high or low tide was noted nor was the velocity of the sea breeze greater on a rising than on a falling tide.

5. Sounding-balloon observations made on 31 clear days give means as follows:

TABLE 2.—*6:30 a. m.*

Elevation (meters)	0	100	200	300	400	500	600	800
Direction	S. 22° E.	S. 7° E.	S.	S. 25° E.	S. 38° E.	S. 51° E.	S. 73° E.	S. 79° E.
Speed (m. p. s.)	0.9	1.5	1.5	1.5	2.1	2.5	3.2	3.5
Elevation (meters)	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**	**3,500**	**4,000**	
Direction	S. 89° E.	N. 84° E.	N. 54° E.	N. 29° E.	N. 25° W.	N. 15° W.	N. 32° W	
Speed (m. p. s.)	3.3	2.7	2.7	1.0	1.7	1.8	3.5	

TABLE 3.—*1 p. m.*

Elevation (meters)	0	100	200	300	400	500	600	800
Direction	N. 31° W.	N. 39° W.	N. 34° W.	N. 25° W.	N. 7° W.	N. 27° E.	N. 70° E.	E.
Speed (m. p. s.)	2.3	1.2	1.2	1.2	0.8	0.6	0.7	1.6
Elevation (meters)	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**	**3,500**	**4,000**	
Direction	S. 87° E.	S. 32° E.	S. 10° E.	S. 25° W.	N. 33° W.	N. 68° W.	N. 53° W.	
Speed (m. p. s.)	0.9	1.5	0.9	0.4	1.5	2.7	3.5	

From these tables it will be seen that land and sea breezes up to an altitude of 400 meters maintain practically the same direction as at the surface. The wind direction above turns counter clockwise with ascent in the morning and clockwise in the afternoon. The alternation of the land and sea breeze completely disappears at 1,000 meters, but still higher the turning of the wind counterclockwise in the morning and clockwise in the afternoon is observed. The directions are opposite at 2,500 meters and become the same again at 4,000 meters.—*R. H. W.*

THE SEA BREEZE ON THE COAST OF CATALONIA.

[Sobre los vents estivals de conveccio a la costa Catalana, per Eduard Fontseré, Profesor a la Facultad de Ciencias de Barcelona, Director de la Estacion Aerológica. Barcelona, 1918.]

Amongst the numerous meteorological phenomena of which the general principles are known but the details vague, land and sea breezes occupy a leading place. No adequate study of the subject has been made in this country [British Isles], and Prof. Fontseré's memoir, which is devoted to the winds of the Spanish coast of the Mediterranean, may be welcomed as showing the right line of investigation. A large number of observers were found who collaborated in keeping records of the wind throughout day and night, noting the strength and direction every few hours and also the times of onset of the land and sea breezes and other salient changes. By combining the information collected from these observers with the results of the observations at the aeronautical station an adequate picture of the air movements could be constructed.

Although the prevailing upper currents across the coast in summer are from northwest, the land breeze is not developed with the same regularity as the sea breeze. On the coast line the sea breeze reaches its maximum strength about 13h. and it gradually works its way inland, the maximum at 30 kilometers or so from the coast occurring at 17h. The maximum sea breeze comes from the south, making an angle of about 45° with the shore, and the return current (in the layer from 1,000 to 3,000 meters) is from the west, so that the air tracks are flattened helices some 50 kilometers wide and 3 kilometers high. The ascending part of each helix is indicated by cumulus cloud, near the coast at midday, farther inland toward evening. Prof. Fontseré's work is provided with maps and diagrams which "talk" and would repay careful study.—*Met. Off. Circ. 34, Apr. 1, 1919, p. 4.*

LAND AND SEA BREEZES AT SIERRA LEONE.

[Met. Off. Circ. 3, Aug. 21, 1916, p. 4.]

The following figures, compiled from the original returns, show how different the prevailing winds at Sierra Leone are in the morning and evening:

	9h.			17h.		
	Frequency of winds from—					
	NE., E., SE.	W., SW.	Calms, etc.	NE., E., SE.	W., SW.	Calms, etc.
Winter, 90 days (Dec.–Feb.)	54	4	22	1	46	43
Spring, 92 days (Mar.–May)	52	27	13	1	65	
Summer, 92 days (June–Aug.)	30	31	31	1	58	
Autumn, 91 days (Sept.–Nov.)	53	13	25	0	66	25

THE FIRST SUCCESSFUL NON-STOP TRANS-ATLANTIC FLIGHT.

Within less than a month after the successful crossing of the Atlantic by the NC–4 a non-stop flight direct from Newfoundland to Ireland was made by Capt. John Alcock, pilot, and Lieut. Arthur W. Brown, navigator, of the British Royal Air Force. The Newfoundland coast was crossed at 5:28 p. m., Greenwich meridian time, June 14, and the Irish coast at 9:25 a. m., June 15, the entire distance of 3,040 kilometers, or 1,890 statute miles, having thus been traversed in practically 16 hours. If we assume that there were few deviations from a great circle course and that little time was lost in changing altitude, it appears that on the average an actual speed of about 53 m. p. s., or 118.5 m. p. h., was maintained.

Wind conditions for the flight were very nearly ideal, for not only did they furnish an average assistance of approximately 12 m. p. s., 25 to 30 m. p. h., but their direction was such (see Charts X and XI) as to enable the aviators to keep their machine true to course in spite of the handicap due to inability to check that course by means of observations. The weather, aside from the wind, was most unfavorable, as indicated in the published reports of the aviators. We quote from *Nature*, London, June 19, 1919, p. 306:

"Clouds were met at all altitudes (including dense fog in the lower levels) and it was generally impossible to see either ocean or sky. At the higher altitudes the machine became covered with ice, and at one time the air-speed indicator became clogged. The sense of horizontality was for the time lost, and the machine executed various evolutions until it had fallen so low that the sea became visible, and Capt. Alcock was able to recover a normal attitude.

"Only four observations of position were taken during the flight, these being made with reference to the sun, the moon, the pole star and Vega, respectively. All ships were warned that the flight was taking place, and asked to wireless their positions, but the aviators received no messages to guide them, and were entirely dependent on their own scanty observations.

"The average altitude was about 4,000 feet, but attempts were made to find better atmospheric conditions at various altitudes up to 11,000 feet without success."

From the foregoing it is evident, as has been stated elsewhere, that wind assistance is of prime importance. In the absence of radio reports from ships at sea and of observations with greater frequency than were made it would have been practically impossible to steer the correct course that was maintained without winds almost exactly parallel to that course. Moreover, the experience of Alcock and Brown, as well as that of the NC planes, Hawker and Grieve, and more recently the British dirigible R 34, shows that days with favorable weather for observational purposes are rare indeed, at least for any considerable portion of the journey. Hence a flight, if started during adverse wind conditions, is almost certain to meet with failure, until more efficient radiodirectional apparatus is perfected or until aircraft are produced of such speed as to be relatively independent of winds that are ordinarily encountered. —*W. R. Gregg.*